Short communication
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The influence of stems and oak chips on the fermentation and color stabilization during maturation of red wines produced by cv. Shesh i Zi

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ABSTRACT

In Albania the autochthonous cv. *'Shesh i Zi'* it is well known for red wine production. During the wine production, the main problem with this variety is the collapse of its color after alcoholic fermentation. The purpose of this study is to assess the impact of oak chips and stems during alcoholic fermentation. In this study, were used 100 kg grapes of cv. *'Shesh i Zi'* from Tirana area. For the production of wines were used three different vinification schemes (classic, oak chips and stems). The wines were analyzed by spectrophotometric methods such total tannins, total anthocyanins, color parameters. The obtained results were statistically analyzed with Statistix 9 software. Wines produced in the presence of stems and oak chips increase the formation of bonds between tannins and anthocyanins preserving the color of the wines.

Keywords: alcoholic fermentation,total tannins, total anthocyanins, color of wine

INTRODUCTION

Wine is a highly complex alcoholic beverage, which contains a high number of components that influence its quality. Phenolic compounds are always present, and they contribute significantly to the color, aroma, bitterness and astringency of the final product. One of the components of special interest in red wine are tannins. The proportion of tannins expressed as epicatechin units is different in skin (5%), stem (15%), and seed (30%) (Cheynier at al., 2006). Tannins have antioxidant properties (Okuda et al., 2009), and react with anthocyanins forming the copigmentation complex (Bolton, 2001), which show a strong covalent bond with them, providing protection against oxidation and retaining ionized forms of anthocyanins (Bilko et al., 2019). On the other hand, anthocyanins are ingredients of high interest, these components determine the color of rosé and red wines. During the vinification process, anthocyanins are quickly extracted, but they can be very unstable and easily oxidized (Bilkoet al., 2019).

During a wine aging, it is important to stabilize the color and protect it from oxidation, which depends on the amount of ingredients such as tannins and anthocyanins found in wine.

The addition of oenological tannins or the use of oak chips has been described by many authors as a positive attribute in wine production (Olga Pascual et al., 2016; Springer et al., 2016; Bilko et al., 2019). Related to this fact the subject of this study is to evaluate these components using stems and oak chips instead of oenological products with the purpose to increase the content of tannins in the wine, in order to achieve stabilization of the wine color during the fermentation steps and their effect on

wine aging. In this study, cv. *"Shesh i zi"* was taken into consideration because it is one of the most cultivated varieties of Albania and is characterized by a high intensity of the color of the grape berry (Kukali et al., 2017). The wines produced by this variety have shown a problem, which after alcoholic fermentation are characterized by a loss of color.

MATERIALS AND METHODS

This study is carried out using the variety (*Vitis vinifera* L.) Sheshi i Zi from Tirana area during the vintage 2018 – 19. For this work were taken 100 kg of grapes, which were split into three lots, approximately 30 kg for each one. The experiments carried out for this study is three fermentations schemes; first experiment is classic fermentation (SL1C), the second fermentation was in the presence of oak chips (SL2CH), while the third one was carried out in the presence of 50% of the stems mass (SL3F). The musts were treated with a dose of 5g/hl SO_2, for inoculation were used 20 g/hl of S. bayanus BC yeast and fermented at controlled temperature of 20-22°C for 10 days. When the fermentation was complete, the wines were treated with 50mg/L SO_2 and kept at 18±2°C in the dark, until their analyzation.

The samples were taken for analysis in the beginning, in the peak and at the end of fermentation. During maturation of wine the samples were taken for analysis at three different periods of the year (December, March and June). The analytic determination included: free and total of sulfuric anhydride, total acidity, volatile acidity and alcoholic grade (Method OIV-MA-AS313-01), content of tannins (Porter et al., 1985), total anthocyanins (Puissant and Leon, 1967) and color parameters according to Glories (1984).

The experiment was conducted as a randomized block design with three replications and the data was analysed using The Statistix program, Version 9.0 (Analytical Software), ANOVA design factorial and test Tukey for comparing treatment means.

RESULTS AND DISCUSSION

Wine samples were initially analyzed for quality parameters (free and total sulfuric anhydride, total and volatile acidity as well as alcoholic grade). The levels of these parameters did not exceed the limits established by the Regulation of EEC 1990.

Table 1 shows the mean values of total tannin content in wines analyzed in this study (fermentation with stems (SL3F), fermentation with oak chips (SL2CH) and control test (SL1C)). As can be seen in Table 1 the highest mean value of the total tannin content is represented by the classic fermentation SL1C (2,857 ± 0.01 mg/L), while the wine produced in the presence of oak chips represents the lowest value (2,477 ± 0.01 mg/L). According to the literature, stems are a source of tannins (Suriano et al., 2015), and alcoholic fermentation favors the extraction of this content, however, the results obtained in this study show that, the total content of tannins is lower in wines obtained with the addition of stems and oak chips, these results are not similar to those obtained by Olga Pascual et al. (2016).

Table 1. Performance oftannins content duringfermentation days of Sheshi i Zi wines

Samples	Fermentation days	Total Tannins
SL1C[b]	1[c]	1.610 ± 0.00[a]
	2	2.631 ± 0.05
	3	2.857 ± 0.01
SL2CH	1	1.610 ± 0.00
	2	2.413 ± 0.05
	3	2.477 ± 0.01
SL3F	1	1.610 ± 0.00
	2	2.349 ± 0.00
	3	2.511 ± 0.00

a – Mean + SD

b–SL1C–classic fermentation; SL2CH–fermentation with oakchips; SL3F–fermentation with 50% of stems.

1 –beginning of fermentation; 2 – peak of fermentation; 3 – end of fermentation

Table 2 shows the contents of total tannins in the wines during maturity, as can be seen all the wines analyzed have a tendency to increase their mean values in this compound. The highest mean values in the total tannin content are found in the wine produced by classic fermentation (4,152 ± 0.06 mg/L), while the wine produced by fermentation with the presence of stems has shown lower mean value (2,822 ± 0.00 mg/L).

During maturation, it is noted that wines produced with the addition of oak chips increase the content of total tannins, however, wines produced by fermentation in the presence of stems do not show changes during this period. When these two treatments are compared, with the statistical analysis of the ANOVA factor design, is observed a significant difference between them with a P> .05.

Table 2. Performance of total tannins content during maturation of Sheshi i Zi wines

Samples	Storage	Total Tannins
SL1C[b]	1[c]	2.857 ± 0.01[a]
	2	3.165 ± 0.01
	3	4.152 ± 0.06
SL2CH	1	2.477 ± 0.01
	2	3.314 ± 0.03
	3	3.452 ± 0.06
SL3F	1	2.511 ± 0.00
	2	2.695 ± 0.00
	3	2.822 ± 0.00

a – Mean + SD

b – SL1C-classic fermentation, SL2CH-fermentation with oak chips, SL3F-fermentation with 50% of stems

c –, 1 – Samples of Decembre, 2 – samples of March, 3 – samples of June

Table 3 shows the influence of fermentation treatment on the total anthocyanin content. In general, in this study, the wine produced by the presence of stems has a significant higher anthocyanin concentration than control (SL1C) and SL2CH (oak chips). Otherwise, Suriano et al. (2015) mention that during alcoholic fermentation, the presence of stems can decrease the concentration of total anthocyanins, since the stems are able to absorb these components, but the presence of stems during fermentation, extract the tannins and polyphenols, which protect anthocyanins from oxidation (de Llaudy et al., 2008). According to the results obtained, the total amount of anthocyanins is greater when the fermentation was carried out in the presence of stems, the increase of the concentration of total anthocyanins in this study is similar to those obtained by Olga Pascual et al. (2016).

Table 3. Performance of anthocyanins during fermentation days of Sheshi i Zi wines

Samples	Fermentation days	Total anthocyanins
SL1C[b]	1[c]	318.87 ± 2.73[a]
	2	313.41 ± 0.00
	3	321.37 ± 0.39
SL2CH	1	320.69 ± 0.39
	2	289.96 ± 0.79
	3	286.78 ± 1.18
SL3F	1	392.38 ± 0.39
	2	386.46 ± 1.18
	3	349.37 ± 0.39

a – Mean + SD

b - SL1C–classic fermentation, SL2CH–fermentation with oak chips, SL3F–fermentation with 50% of stems

c – 1 - beginning of fermentation, 2 – peak of fermentation, 3 – end of fermentation

Table 4 presents the mean values of total anthocyanins content during the maturation of the wines obtained in the study. As can be seen from the table, the wines obtained by fermentation with stems (SL3F) shown higher mean values of anthocyanins compared to wines SL1C and SL2CH.

Statistical analysis (ANOVA factorial design) showed that the content of total anthocyanins in fermentation with stems (SL3F) show higher content of this component, and is significantly different P<0.05 in comparison with the wines produced with oak chips and control (Figure 1).

The results regarding color parameters of wines produced by cv. Sheshi i Zi in three different fermentation schemes, are presented in Table 5.

Table 4. Performance of total anthocyanins during maturation of Sheshi i Zi wines

Samples	Storage	Total anthocyanins
SL1C[b]	1[c]	321.37 ± 0.39[a]
	2	386.46 ± 1.36
	3	245.58 ± 0.39
SL2CH	1	286.78 ± 1.18
	2	219.29 ± 0.78
	3	151.81 ± 0.39
SL3F	1	349.37 ± 0.39
	2	418.10 ± 1.04
	3	270.57 ± 1.04

a – Mean + SD

b–SL1C–classic fermentation, SL2CH–fermentation with oak chips, SL3F–fermentation with 50% of stems

c – 1 – Sample of Decembre, 3 – samples of March3 – samples of June

The wines produced by the present of stems (SLF3) had significantly higher values of color parameters than wines SL2CH and SL1C. Fermentation with stems also influence in color parameters, this effect comes because of the increased of anthocyanins content. The addition of stems during fermentation confirms that their presence favors anthocyanin extraction and provides protection against oxidation (Olga Pascual et al., 2016).

As can be seen from the table 6, the color intensity during maturation shows decreased values on wines SL1C and SL2CH. The highest value of color intensity is observed in SL3F wine (10.413± 0.01), compared to SL1C control test (9.280 ± 0.02) and SL2CH wine (9.553 ± 0.01).

The wine produced by the addition of oak chips during fermentation decreases the hue and color index, this decrease is statistically demonstrated in the statistical analysis, ANOVA factor design and Tukey test as shown in Figure 2. While the wines obtained by fermentation with the presence of stems shows a higher color intensity (P≤0.05), compared to the wine produced by fermentation with oak chips.

Table 5. Evaluation of color parameters during fermentation daysof wines cv. Sheshi i Zi

Samples	Fermtentation Days	Hue of color	Index of color	Intensity of color
SL1C[b]	1[c]	0.591 ± 0.00[a]	1.693 ± 0.00	9.500 ± 0.00
	2	0.429 ± 0.00	2.328 ± 0.00	8.077 ± 0.00
	3	0.471 ± 0.00	2.121 ± 0.01	8.620 ± 0.01
SL2CH	1	0.522 ± 0.00	1.915 ± 0.01	8.053 ± 0.02
	2	0.443 ± 0.00	2.257 ± 0.00	7.420 ± 0.00
	3	0.505 ± 0.00	1.980± 0.01	7.620 ± 0.01
SL3F	1	0.588 ± 0.00	1.702 ± 0.00	10.940 ± 0.02
	2	0.588 ± 0.00	2.169 ± 0.00	9.577 ± 0.01
	3	0.528 ± 0.00	1.894 ± 0.02	9.703 ± 0.00

a – Mean + SD

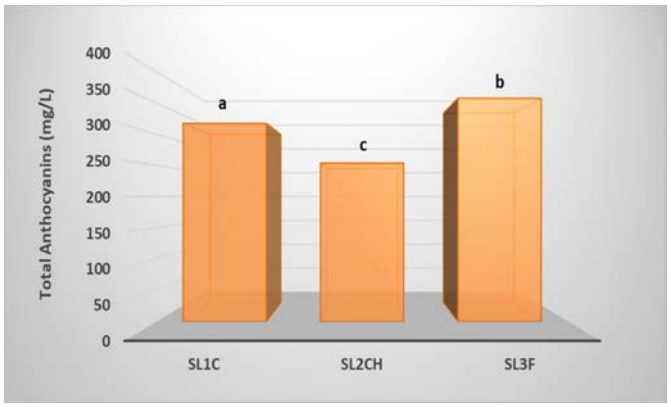
b–SL1C–classic fermentation, SL2CH–fermentation with oak chips, SL3F–fermentation with 50% of stems

c – 1 - beginning of fermentation, 2 – peak of fermentation, 3 – end of fermentation

Table 6. Evaluation of color parameters during maturation of wines cv. Sheshi i Zi

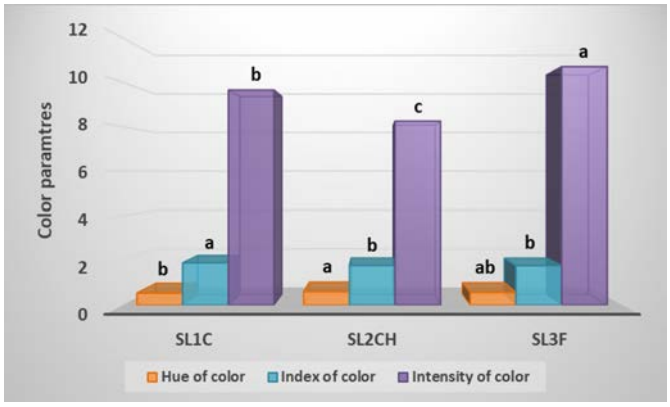
Samples	Storage	Hue of color	Index of color	Intensity of color
	1[c]	0.471 ± 0.00[a]	2.121 ± 0.01	8.620 ± 0.01
SL1C[b]	2	0.539 ± 0.00	1.855 ± 0.00	12.797 ± 0.01
	3	0.703 ± 0.00	1.532 ± 0.00	9.280 ± 0.02
	1	0.505 ± 0.00	1.980± 0.01	7.620 ± 0.01
SL2CH	2	0.677± 0.00	1.578 ± 0.00	8.586± 0.01
	3	0.850 ± 0.00	1.176 ± 0.00	9.553 ± 0.01
	1	0.528 ± 0.00	1.894 ± 0.02	9.703 ± 0.00
SL3F	2	0.594 ± 0.00	1.684 ± 0.00	13.853 ± 0.11
	3	0.703 ± 0.00	1.423 ± 0.00	10.413± 0.01

a – Mean + SD
b–SL1C–classic fermentation, SL2CH–fermentation with oak chips, SL3–fermentation with 50% of stems
c – 1 – Sample of Decembre, 3 – samples of March 3 – samples of June



SL1C - classic fermentation, SL2CH - fermentation with oak chips, SL3F - fermentation with 50% of stems

Figure 1. Influence of different fermentation schemes on total anthocyanins content of the wines taken in study (Tukey Test, P≤0.05)



SL1C–classic fermentation, SL2CH–fermentation with oak chips, SL3F–fermentation with 50% of stems

Figure 2. Evaluation of color in wines produced by three different vinification schemes (Tukey Test, P≤0.05)

CONCLUSIONS

From this study, it can be concluded that the addition of oak chips and stems during fermentation does not affect the quality parameters of the wines produced by the cv. Shesh i zi.

The use of oak chips during the fermentation, and maturity of wines, allows obtaining wines with high content of total tannins, nevertheless, the presence of oak chips decreases the content of anthocyanins and color parameters.

The wines produced by fermentation with stems showed a higher content of total anthocyanins compared to the wines produced by fermentation with oak chips and classic fermentation. Wines produced in the presence of stems increase the formation of bonds between tannins and anthocyanins while preserving the color of the wines compared to wines with the addition of oak chips.

Further studies are required to see the effect of the relationship of tannins with anthocyanins extracted by stems and oak chips, to better understand the formation of bonds between these compounds.

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